FATTY ACID COMPOSITION OF LIMITED USE IN APHID TAXONOMY

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Abstract

An examination, by gas-liquid chromatography, of fatty acids within the various neutral lipid fractions of the milkweed aphid, *Aphis asclepiadis* Fitch, shows that myristic acid (C:14) is the major fatty acid in glycerides. C:16 and C:18 fatty acids are predominant in the other lipids. Total neutral lipid analyses reflect the composition of triglyceride which comprises 87.1 per cent of the lipid.

Following periods of starvation the composition of fatty acids within each lipid fraction remains the same, but if the total neutral lipid is analyzed before separation into its fractions C:14 appears to decrease and C:18 fatty acids increase. This change is due to utilization of triglyceride during starvation causing a lowered amount of triglyceride in the total neutral lipid sample.

It is suggested that carefully controlled experiments combined with biochemical improvements in fatty acid analysis will be necessary if fatty acid composition is to be used as a taxonomic tool at the species level.

Aphids have been characterized as having high concentrations of myristic acid (C:14) (Strong, 1963; Barlow, 1964; Fast, 1966) and it has been suggested that fatty acid composition might be of use to the insect taxonomist (Gilbert, 1967). The high percentage (i.e., $> 50\%$) of myristic acid was found only in neutral lipids and not in phospholipids (Fast, 1966) and, unfortunately, the neutral lipid fraction was not further separated into its individual components for more detailed fatty acid analyses in any of the studies. I have examined fatty acids within the various neutral lipid fractions of the milkweed aphid, *Aphis asclepiadis* Fitch, to determine the feasibility of using chemical composition as a taxonomic tool.

Nymphs and adults were collected in the field from a single stand of the common milkweed, *Asclepias syriaca*. The insects were divided into nine equal lots for analysis. Three lots each were examined immediately, and after 24 hr. and 48 hr of starvation. Only water was provided during the periods of starvation and the insects were held in the laboratory at 22° C and 50% R.H.

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Lipids were extracted, fractionated, and quantitated as described previously (Yurkiewicz and Whelchel, In press). Fatty acids were prepared using the boron trifluoride technique of Metcalfe and Schmitz (1961). Standard gas chromatographic techniques (F and M Scientific Methods Bulletin No. 117) including the use of 6% diethylene glycol succinate columns at 190° C and a hydrogen flame detector were employed.

The results indicate that the neutral lipids of aphids analyzed immediately comprise 11 per cent of the wet weight and contain 87.1 per cent triglyceride, 8.2 per cent sterol ester and hydrocarbon, 2.2 per cent mono- and diglyceride, 1.5 per cent free fatty acid and 1.0 per cent sterol. After 24 and 48 hr. of starvation, the triglyceride fraction had decreased to 79.4 and 72.5 per cent, respectively, of the neutral lipid fraction. There was a corresponding increase in the per cent composition of all other neutral lipid fractions.

The fatty acid composition of *A. asclepiadis* analyzed immediately after collection is shown in Table 1. It is interesting that myristic acid (C:14)

TABLE 1. Fatty acids in the lipids of the milkweed aphid, *Aphis asclepiadis* Fitch

Lipid Fraction	Per Cent Composition of Fatty Acids									
	12	14	14:1	16	16:1	18	18:1	18:2	18:3	>18:3
Triglyceride	3.5	77.6	t[1]	18.8	t	t	t	t	t	t
Mono- and diglyceride	t	32.2	t	22.4	6.9	9.5	15.2	8.1	5.3	t
Free fatty acid	3.2	18.0	t	34.0	8.2	14.2	15.9	5.3	1.2	t
Sterol ester	t	15.7	t	15.6	6.0	4.1	31.4	24.7	1.5	t
Total neutral lipid	2.2	71.0	t	16.5	1.1	2.5	3.2	3.5	t	t
Phospholipid	1.3	18.1	1.0	5.9	3.1	3.9	24.4	28.5	10.2	2.6

[1] t = trace, less than 1.0 per cent.

is the major fatty acid (> 50%) only in the triglyceride fraction. Total neutral lipid fatty acids are, of course, reflecting the composition of triglyceride, the major neutral lipid. After 24 and 48 hrs. the per cent composition of fatty acids within each fraction remained essentially the same, but by 48 hr. the amount of C:14 within the total neutral lipid fraction had decreased from 71 to 62 per cent. Concomitantly, the amounts of C:18, 18:1, 18:2, and 18:3 increased. This change is obviously due to the lowered amount of triglyceride in the total neutral lipid pool following starvation.

The great disparity in fatty acid composition among the neutral lipid fractions indicates that studies on the fatty acids within each fraction would

be more useful than information on total neutral lipid fatty acids. Furthermore, that physiological state must be carefully controlled is clearly shown when fatty acids are examined following starvation. Myristic acid decreased significantly following a relatively short period of foot deprivation. A change of this magnitude suggests that fatty acid composition could vary from one insect sample to another thus making fatty acid taxonomic identifications difficult. It is probable that carefully controlled experiments combined with biochemical improvements in fatty acid analysis will be necessary if fatty acid composition is to be used as a taxonomic tool at the species level.

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